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Nomograph for Prediction of RF-Breakdown Voltages

A nomograph has been developed for predicting rf voltage ionization breakdown levels in aircraft or spacecraft electronic equipment used in low-pressure environments. The information in the nomograph is derived from data obtained from rf-breakdown tests on components of uniform and nonuniform geometry.

The rf-breakdown voltage is a function of two variables, fd and p/f ; fd is the operating frequency in MHz multiplied by the distance d in cm between two electrical surfaces at different potentials; p/f is pressure in torrs divided by the frequency in MHz. The nomograph is applicable for fd values in the range of 10 to 100 MHz-cm, a critical range for VHF and UHF equipment, because ionization breakdown levels rise significantly as the fd product decreases below 100 MHz-cm, and multipacting is forbidden for fd values below 70 MHz-cm. The corresponding p/f values where minimum breakdown occurs ($10 \leq fd \leq 100$ MHz-cm) extends from 4×10^{-1} to 10^{-3} torr/MHz. It is emphasized that the nomograph is considered valid for nonuniform electrode geometries.

Ordinarily, for a range of linear distances between conductors, the nomograph can be used to determine the minimum rf breakdown voltage for a p/f value, but it can also be used to predict the functional

change in voltage breakdown with pressure or frequency where a range of fd values occur. The nomograph also can be used in design work to predict breakdown margins; if an operational minimum pressure is established giving a p/f minimum value on the nomograph, a minimum breakdown voltage consistent with an allowed fd value can be predicted.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
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Patent status:

NASA has decided not to apply for a patent.

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Category 01